



The air and water grow heavier with the debris of our spectacular civilization.

Lyndon B. Johnson

message to Congress, 30 January 1967

### Meeting of the Minds on Mercury

In an attempt to reconcile a body of controversial and conflicting scientific evidence, scientists and government representatives gathered 18–20 November 1998 in Raleigh, North Carolina, to discuss several studies on the health effects of methylmercury (MeHg), an organic form of mercury that bioaccumulates in fish and other seafood. The workshop was organized at the request of the White House Office of Science and Technology Policy, and was chaired by the NIEHS.

For the first time, researchers compared at once the studies conducted to date on populations in Iraq, the Faroe Islands, the Seychelles, and the Amazon Basin. Because of their seemingly contradictory findings, these studies have stirred up controversy over how high the acceptable threshold for exposure to MeHg should be set.

The original Iraqi study, by Thomas Clarkson of the University of Rochester in New York, looked at 84 mother–child pairs who had been poisoned by consuming contaminated grain in the winter of 1971–1972. This study found that MeHg in the mothers' hair at levels over 10 parts per million appeared to be related to neurodevelopmental abnormalities in offspring. Clarkson and colleague Philip Davidson undertook the Seychelles study in 1989 to test the Iraqi findings on a larger population, but the prospective, longitudinal main study of 779 children to age five showed no association with neurodevelopment. The scientists concluded that the low levels of mercury found in the ocean fish eaten by the Seychellois pose no health risks.

In the Faroe Islands, Philippe Grandjean and colleagues from the University of Odense in Denmark administered a battery of neurodevelopmental tests to 917 seven-year-olds whose mothers showed hair mercury concentrations of 10–20  $\mu\text{g/g}$ . The team found a correlation between mild neurodevelopmental deficits and maternal MeHg exposure, indicating that MeHg exposure *in utero* may cause negative health effects.

Studies conducted by Donna Mergler of the Université du Québec in Montréal, Canada, among adult tribespeople of the Amazon Basin found that adults with levels of hair mercury below the currently recognized threshold of 50  $\mu\text{g/g}$  demonstrated reduced nervous system function. A second

study confirmed that hair mercury levels were significantly higher for those subjects with reduced motor control and restricted visual fields.

Five expert panels were convened at the workshop to discuss the studies in terms of a framework of questions. The exposure panel looked at relative exposures to organic and inorganic mercury, the sources of the exposures, and whether there were significant confounders. The neurobehavioral end points panel considered the identified health end points and how they were tested, and whether the tests used in the different studies are comparable. The confounders and variables panel scrutinized possible confounders and variability within the study populations. The design and statistics panel compared the statistical design and research protocol of each study and

The contradictory findings may be due to dietary confounders or to ethnic differences in response to MeHg. In addition, the Faroes and Seychelles studies looked at different health end points, conceivably leading to disparate results.

Based on the studies as a whole, MeHg must be considered a neurodevelopmental neurotoxin, although the effects of exposure to low doses is still unclear. The panels called for reevaluation of the two studies using similar assessment techniques and statistical methods to measure parallel health end points. It was also suggested that researchers might test other systems besides the neurodevelopmental system—such as the renal, hematological, and immune systems—for assistance in developing thresholds.

Only days before the workshop, the EPA announced that coal-fired power plants must now measure the mercury content of the coal they burn, and a randomly selected sample of 75 plants must conduct smokestack testing to establish the amount and type of mercury emissions, with the results to be made public beginning in early 2000. This unprecedented move is part of a larger strategic plan to reduce emissions of several persistent, bioaccumulative, and toxic pollutants. It is expected that the panel comments and workshop report will significantly influence future public health policy decisions by the EPA and other agencies.

Some groups feel these steps aren't coming a minute too soon. According to a report entitled *Poisoning Our Future: The Dangerous Legacy of Persistent Toxic Chemicals*, released in November 1998 by U.S. PIRG (the national lobbying office for state-level public interest research groups) and the National Environmental Trust (a nonprofit educational organization), nearly 20 million pounds of mercury and other toxic pollutants are released into the air, land, and water each year. Because reporting thresholds are set too high, the report says, this is only a fraction of the real sum of pollution going into the environment.

George Lucier, director of the NIEHS Environmental Toxicology Program and cochair of the workshop, was pleased with the outcome of the workshop. "This is exactly the kind of thorough analysis that's needed to provide the science base necessary for making public health decisions," he says.



**Smoked fish.** Federal agencies may be close to a coordinated standard for methylmercury, an organic pollutant that accumulates in fish.

assessed their strengths and weaknesses. A fifth experimental panel looked at the contributions of animal and experimental studies toward interpreting the human studies.

The panels stated unanimously that the studies were of high scientific value, and that their results are credible. No obvious reason for the inconsistencies among the studies' findings was identified.